

AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings are submitted as formal drawings.

Attachment: replacement sheets

## REMARKS

Claims 1-8, 10-17, 19-27, 29-38, 40, and 41 are pending in the application. Claims 21-27, 29-38, 40, and 41 have been withdrawn pursuant to a restriction/election of species requirements. Claims 9, 18, 28, and 39 have been cancelled by this amendment without prejudice. No claims are presently allowed.

Claims 1, 10, 21, and 31 have been amended to incorporate the limitation from canceled claims 9, 18, 28, and 39 that the coating is formed by self-limiting electropolymerization.

No new matter has been added.

## Restriction

Applicants affirm the prior election of claims 1-20. Upon allowance of claim 1, Applicants request rejoinder of claims 21-27, 29, and 30 because these claims are drawn to a method of making the composite recited in claim 1. Upon allowance of claim 10, Applicants request rejoinder of claims 32-38, 40, and 41 because these claims are drawn to a method of using the capacitor recited in claim 31.

## Claim Rejections – 35 U.S.C. § 102

Claims 1, 2, 4-6, 10, 11, and 13-15 have been rejected under 35 U.S.C § 102(b) as allegedly anticipated by Bluvshstein et al. (US 2002/0089807).

In order to make a *prima facie* case of anticipation, the reference must disclose each limitation of the claim. *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053, 814 F.2d 628, 631 (Fed. Cir. 1987); MPEP 2131. Among other deficiencies, the reference does not disclose the limitation in claims 1 and 10 that the coating is formed by self-limiting electropolymerization. Neither does the reference disclose any equivalent coating made by other means. Bluvshstein discloses electropolymerization under non-limiting conditions. Aniline is polymerized in 3 M tetrafluoroboric acid (0037). The pK<sub>a</sub> of tetrafluoroboric acid is 0.5 (*CRC Handbook of Chemistry and Physics* (David R. Lide, ed., 75<sup>th</sup> ed. 1994), page 8-44, attached). The pH of this solution is 0.082. As shown in the present specification, self-limiting electropolymerization of arylamine monomers, such as aniline, typically occurs at pH>1 (0025). Thus, the reference does not disclose self-limiting electropolymerization.

Further, the structure disclosed in the reference is different from that formed by self-

limiting electropolymerization. The attached figure “Electrodeposition within nanoarchitectures,” prepared for this response, illustrates the differences. At the low pH used in the reference the polymerization is not self-limiting, since the polymer is conductive. The thickness of the coating can grow until it completely fills the pores closer to the surface of the electrode. The inner portions become depleted of monomer, which cannot be replenished due to the blockage of the pores near the surface. There is very little polymer formed in the inner portions. The same structure would also result from the chemical polymerization disclosed in the reference, as there is no limiting mechanism.

At the higher pH used for self-limiting electropolymerization, the polymer coating is nonconductive. Once the coating is sufficiently thick, for example about 15 nm, further electropolymerization is not possible. As shown in the attached figure, no (or very few) blockages are formed, so the inner portions are not depleted of monomer. The polymer may then uniformly coat all parts of the carbon structure.

As all the claim limitations are not disclosed in the reference, as *prima facie* case of anticipation has not been made. Claims 2, 4-6, 11, and 13-15 depend from and contain all the limitations of claims 1 or 10. The arguments regarding the lack of *prima facie* for claims 1 and 10 are applicable to claims 2, 4-6, 11, and 13-15.

#### Claim Rejections – 35 U.S.C. § 103

Claims 3, 8, 12, 17, 19, and 20 have been rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Bluvshstein.

In order to make a *prima facie* case of obviousness, each claim limitation must be disclosed in the references (MPEP 2143.03). As explained above, the reference does not disclose the limitation in claims 1 (3 and 8 dependent thereon) and 10 (12, 17, 19, and 20 dependent thereon) that the coating is formed by self-limiting electropolymerization. As all the claim limitations are not disclosed in the reference, a *prima facie* case of obviousness has not been made.

Claims 7 and 16 have been rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Bluvshstein in view of Shi (6,383,640).

The references do not disclose the limitation in claims 1 (7 dependent thereon) and 10 (16

dependent thereon) that the coating is formed by self-limiting electropolymerization. As all the claim limitations are not disclosed in the reference, a *prima facie* case of obviousness has not been made.

In view of the foregoing, it is submitted that the application is now in condition for allowance.

In the event that a fee is required, please charge the fee to Deposit Account No. 50-0281, and in the event that there is a credit due, please credit Deposit Account No. 50-0281.

Respectfully submitted,

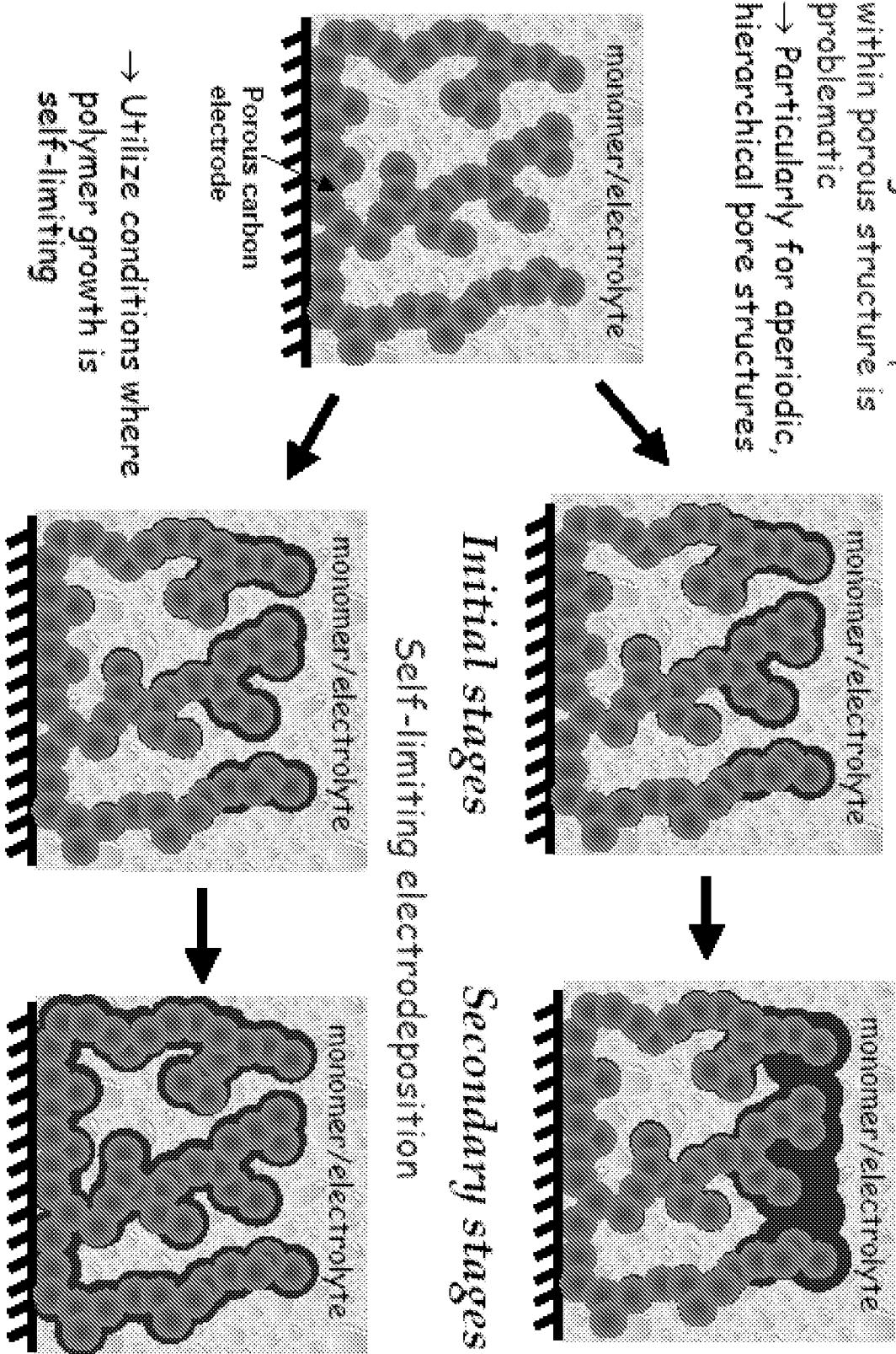
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# Electrodeposition within nanoarchitectures

Poorly controlled electrodeposition

- Controlling electrodeposition within porous structure is problematic

→ Particularly for aperiodic, hierarchical pore structures

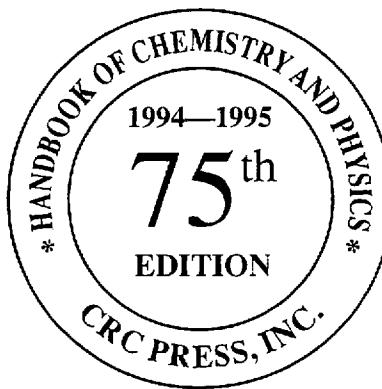


→ Utilize conditions where

polymer growth is self-limiting

# CRC Handbook of Chemistry and Physics

A Ready-Reference Book of Chemical and Physical Data



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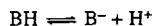
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## DISSOCIATION CONSTANTS OF INORGANIC ACIDS AND BASES

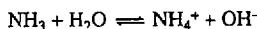
The data in this table are presented as values of  $pK_a$ , defined as the negative logarithm of the acid dissociation constant  $K_a$  for the reaction



Thus  $pK_a = -\log K_a$ , and the hydrogen ion concentration  $[\text{H}^+]$  can be calculated from

$$K_a = \frac{[\text{H}^+][\text{B}^-]}{[\text{BH}]}$$

In the case of bases, the entry in the table is for the conjugate acid; e.g., ammonium ion for ammonia. The  $\text{OH}^-$  concentration in the system



can be calculated from the equation

$$K_b = K_{\text{water}} / K_a = \frac{[\text{OH}^-][\text{NH}_4^+]}{[\text{NH}_3]}$$

where  $K_{\text{water}} = 1.01 \times 10^{-14}$  at 25 °C. Note that  $pK_a + pK_b = pK_{\text{water}}$ .

All values refer to dilute aqueous solutions at the temperature indicated. The table is arranged alphabetically by compound name.

### REFERENCE

1. Perrin, D. B., *Ionization Constants of Inorganic Acids and Bases in Aqueous Solution, Second Edition*, Pergamon, Oxford, 1982.

Name	Formula	Step	T/°C	pK <sub>a</sub>
Aluminum(III) ion	$\text{Al}^{+3}$		25	5.0
Ammonia	$\text{NH}_3$		25	9.25
Arsenic acid	$\text{H}_3\text{AsO}_4$	1	25	2.26
		2	25	6.76
		3	25	11.29
Arsenious acid	$\text{H}_2\text{AsO}_3$		25	9.29
Barium(II) ion	$\text{Ba}^{+2}$		25	13.4
Boric acid	$\text{H}_3\text{BO}_3$	1	20	9.27
		2	20	>14
Calcium(II) ion	$\text{Ca}^{+2}$		25	12.6
Carbonic acid	$\text{H}_2\text{CO}_3$	1	25	6.35
		2	25	10.33
Chlorous acid	$\text{HClO}_2$		25	1.94
Chromic acid	$\text{H}_2\text{CrO}_4$	1	25	0.74
		2	25	6.49
Cyanic acid	$\text{HCNO}$		25	3.46
Germanic acid	$\text{H}_2\text{GeO}_3$	1	25	9.01
		2	25	12.3
Hydrazine	$\text{N}_2\text{H}_4$		25	8.1
Hydrazoic acid	$\text{HN}_3$		25	4.6
Hydrocyanic acid	$\text{HCN}$		25	9.21
Hydrofluoric acid	$\text{HF}$		25	3.20
Hydrogen peroxide	$\text{H}_2\text{O}_2$		25	11.62
Hydrogen selenide	$\text{H}_2\text{Se}$	1	25	3.89
		2	25	11.0
Hydrogen sulfide	$\text{H}_2\text{S}$	1	25	7.05
		2	25	19
Hydrogen telluride	$\text{H}_2\text{Te}$	1	18	2.6
		2	25	11
Hydroxylamine	$\text{NH}_2\text{OH}$		25	5.94
Hypobromous acid	$\text{HBrO}$		25	8.55

DISSOCIATION CONSTANTS OF INORGANIC ACIDS AND BASES (continued)

Name	Formula	Step	T/°C	pK <sub>a</sub>
Hypochlorous acid	HClO		25	7.40
Hypoiodous acid	HIO		25	10.5
Iodic acid	HIO <sub>3</sub>		25	0.78
Lithium ion	Li <sup>+</sup>		25	13.8
Magnesium(II) ion	Mg <sup>2+</sup>		25	11.4
Nitrous acid	HNO <sub>2</sub>		25	3.25
Perchloric acid	HClO <sub>4</sub>		20	-1.6
Periodic acid	HIO <sub>4</sub>		25	1.64
Phosphoric acid	H <sub>3</sub> PO <sub>4</sub>	1	25	2.16
		2	25	7.21
		3	25	12.32
Phosphorous acid	H <sub>3</sub> PO <sub>3</sub>	1	20	1.3
		2	20	6.70
Pyrophosphoric acid	H <sub>4</sub> P <sub>2</sub> O <sub>7</sub>	1	25	0.91
		2	25	2.10
		3	25	6.70
		4	25	9.32
Selenic acid	H <sub>2</sub> SeO <sub>4</sub>	2	25	1.7
Selenious acid	H <sub>2</sub> SeO <sub>3</sub>	1	25	2.62
		2	25	8.32
Silicic acid	H <sub>4</sub> SiO <sub>4</sub>	1	30	9.9
		2	30	11.8
		3	30	12
		4	30	12
Sodium ion	Na <sup>+</sup>		25	14.8
Strontium(II) ion	Sr <sup>2+</sup>		25	13.2
Sulfamic acid	NH <sub>2</sub> SO <sub>3</sub> H		25	1.05
Sulfuric acid	H <sub>2</sub> SO <sub>4</sub>	2	25	1.98
Sulfurous acid	H <sub>2</sub> SO <sub>3</sub>	1	25	1.85
		2	25	7.2
Telluric acid	H <sub>2</sub> TeO <sub>4</sub>	1	18	7.68
		2	18	11.0
Tellurous acid	H <sub>2</sub> TeO <sub>3</sub>	1	25	2.48
		2	25	7.7
Tetrafluoroboric acid	HBF <sub>4</sub>		25	0.5
Thiocyanic acid	HSCN		25	-1.8
Water	H <sub>2</sub> O		25	13.995

This  
solution  
Dissoc  
Corr